

Chapter

5

Percentages

Learning Objectives

After completing this chapter, you will be able to

- understand the meaning of percentages.
- solve problems involving percentage increases and decreases.
- know more applications of percentage such as profit, loss and discount.



Last month I got a 10% rise in salary because of my good performance. Lucky me!



But my salary was deducted by 10% this month because of my absence and laziness.

Charles got a rise of 10% in his salary last month for his outstanding performance at work. But this month, his salary was deducted by 10% because he had been absent from work for 3 days. In which month did he get a higher salary, this month or last month before his pay rise?



10% rise ... 10% cut ... Well, my salary this month went back to the level before the rise!



What?

How come the salary I got this month is not the same?



Preview

[Basic knowledge and techniques required for this chapter.]

A. Basic Knowledge

We can compare fractions according to the values of the numerators only when their denominators are the same.

Example: (a) $\frac{7}{10} > \frac{3}{10}$

(b) $\frac{64}{125} < \frac{83}{125}$

(c) $\frac{89}{100} > \frac{43}{100}$

B. Basic Technique

1. Compare the values of fractions by making their denominators equal.

Example: Compare $\frac{3}{4}$ and $\frac{5}{6}$,

$$\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$$

$$\frac{5}{6} = \frac{5 \times 2}{6 \times 2} = \frac{10}{12}$$

$$\therefore \frac{3}{4} < \frac{5}{6}$$

2. Arithmetic operations with fractions

Example: (a) $1 + \frac{1}{3} - \frac{1}{2} = \frac{6}{6} + \frac{2}{6} - \frac{3}{6} = \frac{5}{6}$

(b) $15 \times \frac{4}{5} \times \frac{11}{6} = 22$

(c) $18 \div \frac{8}{7} \times \frac{14}{27} = 18 \times \frac{7}{8} \times \frac{14}{27} = \frac{49}{6} = 8\frac{1}{6}$

3. Solve linear equations in one unknown.

Example: Solve the equation $\frac{9}{10}x = 45$.

Solution: $\frac{9}{10}x = 45$

$$\begin{aligned} x &= 45 \times \frac{10}{9} \\ &= \underline{\underline{50}} \end{aligned}$$

5.1 Revision on Percentages

A Meaning of percentages



Class Activity 5.1

Aim: To understand the meaning of percentages

The following are the marks Eva got in her Chinese Language, English Language and Mathematics tests:

	Marks	Fraction of full marks
Chinese Language	14 (Full marks: 20)	$\frac{14}{20}$
English Language	19 (Full marks: 25)	$\frac{19}{25}$
Mathematics	8 (Full marks: 10)	$\frac{8}{10}$

Can you find out at once in which subject she performed the best?

☐

Yes

☒

No

Let us compare her performance in each subject.

$$\text{Chinese Language: } \frac{14}{20} = \frac{14}{20} \times \frac{100}{100} = \frac{70}{100}$$

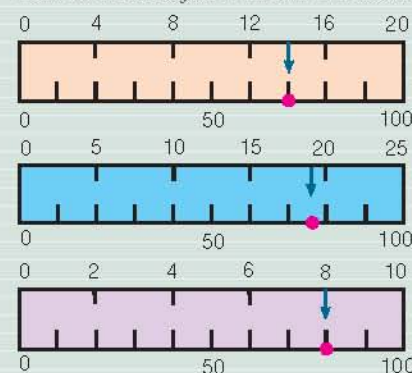
$$\text{English Language: } \frac{19}{25} = \frac{19}{25} \times \frac{100}{100} = \frac{76}{100}$$

$$\text{Mathematics: } \frac{8}{10} = \frac{8}{10} \times \frac{100}{100} = \frac{80}{100}$$

When we use 100 as a standard denominator, we can easily find out that the subject Eva performed the best was

Mathematics

If full marks are 100, the corresponding mark in each subject is shown as follows.



Now I see ...

When we change the denominators of different fractions to 100, the comparison of their values becomes easier.



Percentages are fractions with 100 as the denominator.

Usually, we take $\frac{1}{100}$ as 1% (read as 1 percent).

For example, as shown in the figure, the shaded region is $\frac{25}{100}$, i.e. 25%, of the whole square.

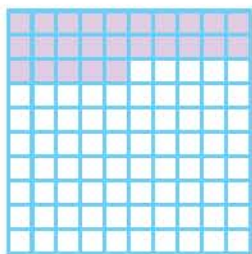


Figure 5.1

B Arithmetic operations with percentages



Example 5.1 Arithmetic operations involving the expression of answers in percentages

Evaluate the following and express your answers in percentages.

- (a) $25\% + 35\%$
- (b) $1 - 45\%$
- (c) $3\% \times 10\%$
- (d) $1 \div 20\%$

Solution

$$\begin{aligned} \text{(a)} \quad 25\% + 35\% &= \frac{25}{100} + \frac{35}{100} \\ &= \frac{60}{100} \\ &= \underline{\underline{60\%}} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 1 - 45\% &= \frac{100}{100} - \frac{45}{100} \\ &= \frac{55}{100} \\ &= \underline{\underline{55\%}} \end{aligned}$$



Classwork 5.1

Evaluate the following and express your answers in percentages.

- (a) $17\% + 23\%$
- (b) $1 - 75\%$
- (c) $16\% \times 20\%$
- (d) $\frac{1}{5} \div 5\%$

$$\begin{aligned} \text{(c)} \quad 3\% \times 10\% &= \frac{3}{100} \times \frac{10}{100} \\ &= \frac{3 \times 10}{100} \times \frac{1}{100} \\ &= \frac{30}{100}\% \\ &= \underline{\underline{0.3\%}} \end{aligned}$$

Remember
 $3\% \times 10\% \neq (3 \times 10)\% !!$



$$\begin{aligned} \text{(d)} \quad 1 \div 20\% &= 1 \div \frac{20}{100} \\ &= 1 \times \frac{100}{20} \\ &= 1 \times 5 \\ &= \underline{\underline{500\%}} \quad \leftarrow 1 = 100\% \end{aligned}$$

Example 5.2 Arithmetic operations with percentages

Evaluate the following.

(a) $40 \times (1 - 30\%)$

(b) $75 \div (1 + 25\%)$

Solution

$$\begin{aligned} \text{(a)} \quad 40 \times (1 - 30\%) &= 40 \times \left(\frac{100}{100} - \frac{30}{100} \right) \\ &= 40 \times \frac{70}{100} \\ &= \underline{\underline{28}} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 75 \div (1 + 25\%) &= 75 \div \left(\frac{100}{100} + \frac{25}{100} \right) \\ &= 75 \div \frac{125}{100} \\ &= 75 \times \frac{100}{125} \\ &= \underline{\underline{60}} \end{aligned}$$

Classwork 5.2

Evaluate the following.

(a) $30 \times (1 + 40\%)$

(b) $132 \div (1 - 80\%)$

Skills Upgrading Corner 5.1

Evaluate the following. (1 – 2)

1. (a) $60 \times 15\%$

(b) $36 \div 48\%$

2. (a) $24 \times (1 + 55\%) \times \frac{30}{31}$

(b) $\frac{2}{3} \times 1.8 \div (1 + 20\%)$



Exercise 5A

Level 1

Evaluate the following and express your answers in percentages. (1 – 4)

1. (a) $15\% + 65\%$ (b) $89\% - 45\%$

2. (a) $2 + 3.5\%$ (b) $1.5 - 27\%$

3. (a) $60\% \times 50\%$ (b) $70\% \times 120\%$

4. (a) $1 \div 25\%$ (b) $1 \div 80\%$

Evaluate the following. (5 – 6)

5. (a) $2 \times 35\%$ (b) $1.5 \times 50\%$

6. (a) $4 \div 25\%$ (b) $105 \div 60\%$

Level 2

Evaluate the following. (7 – 9)

7. (a) $50 \times (1 - 20\%)$ (b) $80 \times (1 + 50\%)$

8. (a) $90 \div (1 + 20\%)$ (b) $140 \div (1 - 30\%)$

9. (a) $\frac{3}{7} \times (1 + 40\%) \div 0.3$ (b) $(1 - 5\%) \div 0.38 \div \frac{5}{6}$

5.2 Simple Problems on Percentage

A Finding percentages

Percentage is a fraction expressing a part of the whole.

A part as a percentage of the whole

$$= \frac{\text{Part}}{\text{Whole}} \times 100\%$$



Example 5.3 Finding the percentage with a part and the whole given

There are 1 050 students in a school and 462 of them go to school by Light Rail every day. Find the percentage of students who go to school by Light Rail.



Solution

Percentage of students who go to school by Light Rail

$$\begin{aligned} &= \frac{462}{1\,050} \times 100\% \\ &= \underline{\underline{44\%}} \end{aligned}$$



Classwork 5.3

There are 116 items in a *godown*, 87 of them have been ordered by customers. What percentage of items in the *godown* have been ordered?



Example 5.4 Finding the remaining part in percentage with a part and the whole given

There are 75 students in a playground and 25 of them are boys. Find the percentage of girls in the playground.

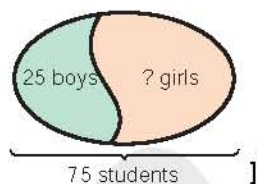


Classwork 5.4

There are 63 students in a library and 42 of them are girls. Find the percentage of boys in the library.

Solution

[Analysis:



$$\begin{aligned} \text{Number of girls in the playground} &= 75 - 25 \\ &= 50 \end{aligned}$$

$$\begin{aligned} \therefore \text{Percentage of girls} &= \frac{50}{75} \times 100\% \\ &= \underline{\underline{66\frac{2}{3}\%}} \end{aligned}$$

B Finding a part

If a part is $p\%$ of the whole, then

$$\frac{\text{Part}}{\text{Whole}} \times 100\% = p\%$$

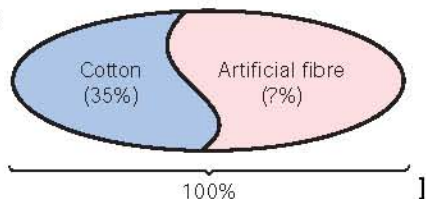
$$\text{Part} = \text{Whole} \times p\%$$

Example 5.5 Finding the remaining part with the whole and percentage of a part given

A shirt is made of cotton and artificial fibre in which 35% is cotton. If this shirt weighs 480 g, find the weight of artificial fibre.

Solution

[Analysis:

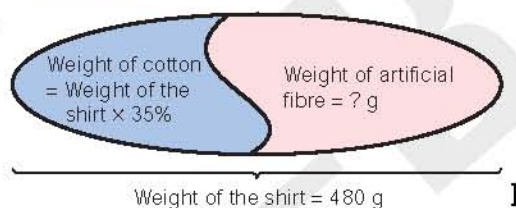


$$\begin{aligned}\text{Percentage of artificial fibre} &= 100\% - 35\% \\ &= 65\%\end{aligned}$$

$$\begin{aligned}\therefore \text{Weight of artificial fibre} &= 480 \times 65\% \text{ g} \\ &= 480 \times \frac{65}{100} \text{ g} \\ &= \underline{\underline{312 \text{ g}}}\end{aligned}$$

Alternative method:

[Analysis:



$$\begin{aligned}\text{Weight of cotton} &= 480 \times 35\% \text{ g} \\ &= 480 \times \frac{35}{100} \text{ g} \\ &= 168 \text{ g}\end{aligned}$$

$$\begin{aligned}\therefore \text{Weight of artificial fibre} &= (480 - 168) \text{ g} \\ &= \underline{\underline{312 \text{ g}}}\end{aligned}$$

Example 5.6 More complicated problem on percentage

There are 160 S1 students and 20% of them wear glasses.

- How many S1 students do not wear glasses?
- If 25% of the students who wear glasses are *long-sighted*, how many S1 students are there with long-sightedness?

Classwork 5.5

The chocolate milk powder of a brand is a mixture of milk powder and chocolate powder, in which 68% is milk powder. If the chocolate milk powder weighs 250 g, find the weight of chocolate powder.

Classwork 5.6

There are 120 members in a rowing club and 30% of them are female.

- How many male members are there in the rowing club?
- If 75% of the female members live on Hong Kong Island, how many female members live on Hong Kong Island?

long-sighted 遠視

Solution

(a) Number of S1 students who wear glasses = $160 \times 20\%$

$$= 160 \times \frac{20}{100}$$

$$= 32$$

$$\therefore \text{Number of S1 students who do not wear glasses} = 160 - 32$$

$$= \underline{\underline{128}}$$

(b) Number of S1 students with long-sightedness = $32 \times 25\%$

$$= 32 \times \frac{25}{100}$$

$$= \underline{\underline{8}}$$

C Finding the whole

If a part is $p\%$ of the whole, then

$$\text{Part} = \text{Whole} \times p\%$$

$$\text{Whole} = \frac{\text{Part}}{p\%}$$

Example 5.7

Finding the whole with a part and its corresponding percentage given

Michael pays \$540 for violin lessons each month, and it takes up 5% of his salary. Find his salary.

Solution

Let \$ x be Michael's salary.

$$x \times 5\% = 540$$

$$x = 540 \div 5\%$$

$$= 540 \times \frac{100}{5}$$

$$= 10\,800$$

\therefore Michael's salary is \$10 800.

**Classwork 5.7**

According to the information from an observatory, the rainfall of a city from May to September last year was 80% of the total rainfall throughout the year. If the rainfall of the city from May to September last year was 1 768 mm, what was the total rainfall throughout last year?

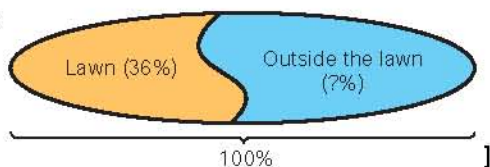


Example 5.8 Finding the whole with a part and percentage of the rest given

In a park, 36% of the area is a *lawn*. If the area outside the lawn is $48\,000\text{ m}^2$, find the area of the park.

Solution

[Analysis:



Percentage of area outside the lawn $= 100\% - 36\%$
 $= 64\%$

Let $A\text{ m}^2$ be the area of the park.

$$\begin{aligned} A \times 64\% &= 48\,000 \\ A &= 48\,000 \div 64\% \\ &= 48\,000 \times \frac{100}{64} \\ &= 75\,000 \end{aligned}$$

\therefore The area of the park is $75\,000\text{ m}^2$.



Classwork 5.8

42% of students in a school live in public housing estates and the remaining 638 students live in private housing estates. How many students are there in the school?



Skills Upgrading Corner 5.2

- In an exhibition, 20 people hold student tickets, 36 people hold adult tickets, and the remaining 24 people hold elderly tickets.
 - What percentage of people is holding student tickets?
 - What percentage of people is holding adult tickets and elderly tickets?
 - By what percentage is the people holding adult tickets more than those holding elderly tickets?
- Among 500 senior form students in a school, 60% of them are boys. It is known that 55% of boys are science students, and 72% of girls are non-science students.
 - How many girls are there in the senior forms of this school?
 - How many girls in the senior forms of this school are non-science students?
 - How many science students are there in the senior forms of this school?



lawn 草坪

3. All volunteers in an activity are seniors and teenagers, and 34% of them are seniors.
 - (a) Find the percentage of the teenage volunteers.
 - (b) If the number of teenagers is 128 more than that of the seniors, how many volunteers are there in total?

Exercise 5B

Level 1

1. (a) What percentage of 52 is 39? (b) What percentage of 3 is 12?
2. (a) How much is 35% of 200? (b) How much is 40% of 125?
3. Find the following unknowns.
 - (a) 60% of x is 54.
 - (b) 150% of y is 63.
4. For every 25 vehicles passing a spot, 17 of them are trucks. What percentage of vehicles are trucks?
5. There are 48 books on a shelf. 19 of them are fictions and 13 of them are detective stories. What percentage of the books are fictions and detective stories?
6. Allen originally has \$50 pocket money. After he goes shopping, only \$12.5 are left. What percentage of the pocket money does he spend?
7. There were 30 pieces of chocolate and Winnie has finished 40% of them. How many pieces of chocolate has she finished?
8. There are 200 animals in a zoo where 6% of them are lions and 8% of them are tigers. How many lions and tigers in total are there in the zoo?
9. Mike answered 80% of the questions correctly in an English Language test. If there were 70 questions in the test, how many questions did he answer wrongly?
10. In a painting competition, 25% of the children are under 6 years old, 45% are between 6 and 9, and the rest are above 9 years old. If there are 180 children in total, find the number of children who are above 9 years old.
11. In a school, 55% of the students are boys. If there are 484 boys, find the total number of students in the school.
12. After filling 18 125 L of water into a tank, 71% of the tank remains unfilled. Find the capacity of the tank.



13. Three telecom companies provide telephone fixed lines in a city. (See the following table)

Company	Global Telecom	Peace Telecom	Smart Telecom
Percentage of users	21%	34%	45%

It is known that there are 1.32 million fixed line users under Global Telecom and Peace Telecom. How many fixed line users are there in this city?

Level 2

14. Annie weighs 36 kg. If her weight is 75% of her mother's, how much heavier is Annie's mother than her in kg?
15. There are 75 passengers in a *double-decker*, and 40% of them are on the upper deck.
- How many passengers are there on the lower deck?
 - If 30% of the passengers on the upper deck are children, how many children are there on the upper deck?



16. There are three types of tickets available for a concert. (See the following table)

Ticket type	\$400-ticket	\$200-ticket	\$100-ticket
Percentage	15%	60%	25%

- It is known that there are altogether 875 \$100-tickets. Find the total number of the tickets available.
 - Suppose 550 people are going to buy \$400-tickets, do you think everyone of them can get one? Explain briefly.
17. 30% of the S1 students bring their own lunchboxes and 55% of them buy lunch at school. If the difference in the number of students between these two groups is 60, find the number of S1 students.
18. In *alloy* A and alloy B, there are 30% and 40% of iron in weight respectively. Now a new alloy is formed by 6 kg of alloy A and 2 kg of alloy B. In the new alloy,
- what is the weight of iron?
 - what percentage of weight is iron?
19. There were 546 male *candidates* and 275 female candidates passing a public examination, which represent 65% of the male candidates and 55% of the female candidates respectively participating in the examination. Find the number of candidates participating in the examination.
20. There are 640 books in the *novel* section of a library. 65% of them are in English and the rest are in Chinese. Now 160 extra Chinese novels are brought to the section.
- How many Chinese novels are there in the section?
 - What percentage of the novels are in Chinese?
 - By what percentage are the English novels more than the Chinese novels?

double-decker 雙層巴士

alloy 合金

candidate 考生

novel 小說

21. The following is the formula of a drink special provided by Healthy Fastfood Restaurant:

Ingredient	Water	Orange Juice	Lime Juice	Syrup
Percentage	55%	25%	15%	5%

Now there are unlimited supply of water and the stock of the other ingredients is as follows:

Ingredient	Orange Juice	Lime Juice	Syrup
Stock	800 mL	600 mL	130 mL

It is known that the capacity of each glass of drink special is 400 mL.

- (a) According to the formula above, which ingredient will run out of stock first? Explain briefly.
 (b) If the stock of the ingredients will not be *refilled*, how many glasses of drink special can be made?

5.3 Percentage Increase and Decrease

A Percentage increase

Class Activity 5.2

Aim: To develop the concept of expressing an increase in percentage

For the preparation of the physical exercise examination, Susan and Indi have a sit-up practice together.

- (a) The number of sit-ups they have done per minute before the practice, and the increase in the number of sit-ups after the practice are recorded as follows. Complete the table.

	Number of sit-ups before practice	Increase in the number of sit-ups after practice	Percentage of the increase
Susan	20	5	25%
Indi	30	6	20%

- (b) Which one has better improvement after the practice?

☒ Susan

☐ Indi

Now I see ...

Apart from expressing an increase in a value, we can also express the relation between the original value and the increase in percentage.



syrup 糖水

refill 補充

In fact, we often express an increase in value as a percentage. We call this increase a **percentage increase**.

$$\text{Percentage increase} = \frac{\text{Increase}}{\text{Original value}} \times 100\%$$

Note: Increase = Original value \times Percentage increase

New value = Original value + Increase

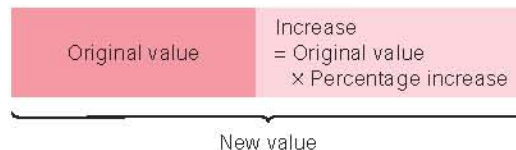


Figure 5.2

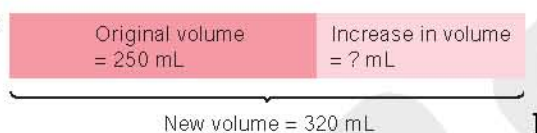
Example 5.9

Finding the percentage increase with original and new values given

The volume of water in a beaker increases from 250 mL to 320 mL. Find the percentage increase in the volume of water.

Solution

[Analysis:



$$\begin{aligned}\text{Increase in volume} &= (320 - 250) \text{ mL} \\ &= 70 \text{ mL}\end{aligned}$$

$$\begin{aligned}\therefore \text{Percentage increase} &= \frac{70}{250} \times 100\% \\ &= \underline{28\%}\end{aligned}$$

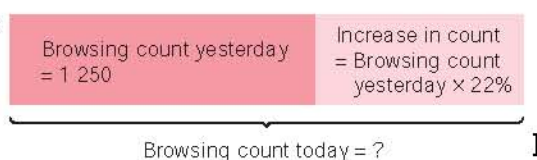
Example 5.10

Finding the new value with original value and percentage increase given

The *browsing count* of a website was 1 250 yesterday. If it increases by 22% today, what is the browsing count today?

Solution

[Analysis:



$$\begin{aligned}\text{Increase in count} &= 1\,250 \times 22\% \\ &= 275\end{aligned}$$

$$\begin{aligned}\therefore \text{Browsing count today} &= 1\,250 + 275 \\ &= \underline{1\,525}\end{aligned}$$

percentage increase 百分增加

Classwork 5.9

The height of Sylvia increases from 150 cm to 154.5 cm. Find the percentage increase in her height.

Classwork 5.10

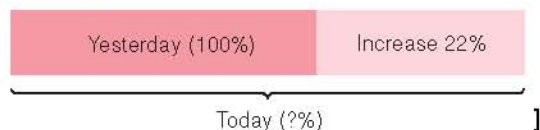
The sales of last issue of a magazine is 5 200. After the promotion, the sales of this issue increase by 33%. Find the sales of this issue.



browsing count 瀏覽次數

Alternative method:

[Analysis:



From the example, we have
New value
= Original value \times (1 + Percentage increase)



$$\begin{aligned}\text{Browsing count today} &= 1\,250 \times (100\% + 22\%) \\ &= 1\,250 \times (1 + 22\%) \\ &= \underline{\underline{1\,525}}\end{aligned}$$

Example 5.11

Finding the original value with percentage increase and new value given

The population of a town has increased by 34% to 3 417. What is the original population of the town?



Solution

Let x be the original population of the town.

$$\begin{aligned}x(1 + 34\%) &= 3\,417 && \leftarrow \text{New value} = \text{Original value} \times (1 + \text{Percentage increase}) \\ x &= 3\,417 \div (1 + 34\%) \\ &= 2\,550\end{aligned}$$

\therefore The original population of the town is 2 550.

Classwork 5.11

Mr. Wong's telephone bill is \$156 in this month, which is 4% more than the bill last month. How much was his bill last month?

B Percentage decrease

Class Activity 5.3

Aim: To develop the concept of expressing a decrease in percentage

In a charity activity, Horace, Christine and William donated \$50 each.



(a) Can you determine who is the most *generous*? Explain briefly.

No. This is because all of them donated \$50 each.

generous 慷慨

(b) The original amount of money for each of them is recorded as follows. Complete the table.

	Original amount (\$)	Donation (\$)	Donation as a percentage of the original amount
Horace	80	50	62.5%
Christine	200	50	25%
William	500	50	10%

(c) Consider the percentage of decrease in their money, who do you think is the most generous? Explain briefly.

Horace. Since his donation as a percentage of the original amount he owned is the greatest among the three, the percentage of decrease in his money is also the greatest.

Now I see ...

Apart from expressing a decrease in a value, we can also express the relation between the original value and the decrease in percentage.



In fact, we often express a decrease in value as a percentage. We call this decrease a **percentage decrease**.

$$\text{Percentage decrease} = \frac{\text{Decrease}}{\text{Original value}} \times 100\%$$

Note: Decrease = Original value \times Percentage decrease

New value = Original value – Decrease

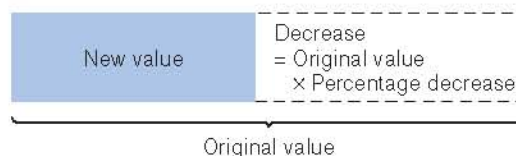


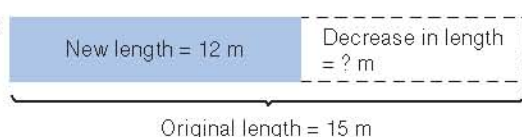
Figure 5.3

Example 5.12 Finding the percentage decrease with original and new values given

After washing, the length of a cloth *shrinks* from 15 m to 12 m. Find the percentage decrease in the length.

Solution

[Analysis:



]

Decrease in length = (15 – 12) m = 3 m

$$\begin{aligned} \therefore \text{Percentage decrease} &= \frac{3}{15} \times 100\% \\ &= \underline{\underline{20\%}} \end{aligned}$$

percentage decrease 百分減少

Classwork 5.12

If the length of an examination is shortened from 120 minutes to 105 minutes, find the percentage decrease in the length of the examination.

shrink 縮水



Example 5.13 Finding the new value with original value and percentage decrease given

75 students were late for school in January. If the total number of students being late for school decreased by 28% in February, how many students were late for school in February?



[Analysis:



$$\text{Decrease in late record} = 75 \times 28\%$$

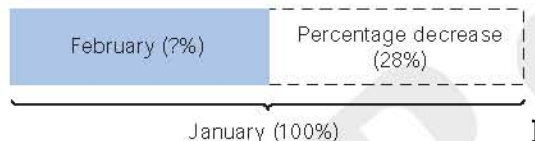
$$= 21$$

$$\therefore \text{Late record in February} = 75 - 21$$

$$= \underline{54}$$

Alternative method:

[Analysis:



$$\text{Late record in February} = 75 \times (100\% - 28\%)$$

$$= 75 \times (1 - 28\%)$$

$$= \underline{54}$$

From the example, we have

New value

$$= \text{Original value} \times (1 - \text{Percentage decrease})$$



Example 5.14 More complicated problem on percentage decrease

For environmental protection, the electricity usage of Mr. Chan's family reduced by 12% to 286 degrees this month.

- Find the electricity usage of Mr. Chan's family last month.
- How much electricity was saved this month?



- Let C degrees be the electricity usage last month.

$$C(1 - 12\%) = 286$$

$$\leftarrow \text{New value} = \text{Original value} \times (1 - \text{Percentage decrease})$$

$$C = 286 \div (1 - 12\%)$$

$$= 325$$

$$\therefore \text{The electricity usage of Mr. Chan's family last month}$$

was 325 degrees.



Classwork 5.13

There were 1 988 crimes in a city in the first season of this year. If the crimes decreased by 25% in the second season, how many crimes in total were there in the first two seasons?



Classwork 5.14

The price of a mobile phone has dropped by 16% to \$2 625.

- What is the original price of this mobile phone?
- By how much has the price of this mobile phone dropped?

(b) Electricity saved = $(325 - 286)$ degrees
 = 39 degrees

Alternative method:

Electricity saved = $325 \times 12\%$ degrees
 = 39 degrees

Skills Upgrading Corner 5.3

- 5 000 tickets of a concert were sold on the first day. The sales on the second day increased by 12%.
 - How many tickets were sold on the second day?
 - If the sales on the third day decreased further by 12%,
 - how many tickets were sold on the third day?
 - Were the sales on the first day and the third day the same? If not, by what percentage was the sales on the third day more/less than that on the first day?
- After raising the price of a product by \$54, its price increased by 6%. What is the new price?
- Sales of Rainbow Department Store were *forecasted* to increase by 16% to \$14.5 million for this season. However, the actual sales for this season only reached \$13.5 million due to the impact of typhoon. What was the percentage increase in the sales for this season?



Exercise 5C

Level 1

Find the percentage increase or decrease in each of the following. (1 – 3)

- Increase 32 by 8
 - Increase x by $\frac{1}{8}$ of the original value
 - Decrease 50 by 7
 - Decrease y by $\frac{3}{4}$ of the original value
- Increase from 10 to 11
 - Increase from 8 to 22
 - Decrease from 16 to 10
 - Decrease from 25 to 14.25

forecast 預測

3. (a) After increasing a value by 2.5, the new value is 22.5.
(b) After decreasing a value by 20, the new value is 60.
(c) After increasing a value by 600, the new value is 900.
(d) After decreasing a value by 98, the new value is 98.
4. Find the new value for each of the following.
(a) Increase 100 g by 6.5% (b) Decrease \$150 by 10%
(c) Decrease 300 km by 99% (d) Increase 32 days by 150%
5. Tracy got 80 marks in a test. It is found that 6 marks were mistakenly given to her and should be deducted. Find the percentage decrease after the deduction of her marks.
6. The number of participants in a reading programme increases from 8 to 32. Find the percentage increase in the number of participants.
7. After a metal rod has been cooled down, the length reduces from 8 cm to 7.88 cm. Find the percentage decrease in the length.
8. Emily has 24 unread emails in her mailbox, in which 6 of them are received today. Find the percentage increase in the unread emails today.
9. There were 12 batteries in each pack of brand A battery. If the manufacturer increases the number of batteries by 25% each pack, how many batteries are there in a new pack of brand A battery?
10. Last year, 320 students participated in the sports day of a school. This year, the number of participants decreased by 37.5%. How many students participated in the sports day this year?
11. There are 21 classmates joining Betty's birthday party this year, which is 5% more than last year's. How many classmates joined the birthday party last year?

Level 2

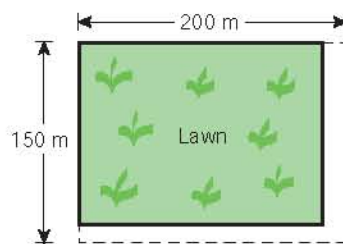
12. Last month, 1 Australian dollar (AUD) could be exchanged for 6 Hong Kong dollars (HKD). This month, 1 AUD can only be exchanged for 5.7 HKD.
(a) Find the percentage decrease in the exchange rate of AUD to HKD.
(b) Daniel exchanged 1 000 AUD for HKD in both last month and this month. Which month did he get more HKD? What is the difference between the two?
13. The balance of Mr. Lee's account this month is 6% more than last month's. If this month's balance is \$48 230,
(a) what was the balance of the account last month?
(b) what is the difference in the balance between the two months?

14. A fast food restaurant sold 102 sets of lunch today. If the number of set lunches sold today is 15% less than yesterday's, find the number of set lunches sold in these two days.



15. After cutting a rope by 14.6 m, its length decreases by 18.25%. Find the length of the remaining part of the rope.
16. (a) Andy's expenditure of this month is 10% more than that of last month. If he spent \$2 400 last month, find his expenditure of this month.
(b) If the expenditure of this month is 40% of his earnings, find his earnings.
17. In the first stage of a fitness programme, Mary lost 2 kg and her weight went down to 48 kg.
(a) What is the percentage decrease in her weight?
(b) Mary lost another 1.2 kg in the second stage. What is the percentage decrease in her weight in the second stage?
18. Rebecca spent \$12 000 on buying the shares of a company at the beginning of February.
(a) After a month, the value of the shares increased by 12%. What was the value of the shares at the beginning of March?
(b) At the beginning of April, the value of the shares was 30% less than that at the beginning of March. What was the value of the shares at the beginning of April?
19. If the numerator of $\frac{2}{5}$ increases by 50% and its denominator decreases by 20%, find the new fraction.

20. The length and width of a rectangular lawn are 200 m and 150 m respectively. If the length and width decrease by 10% and 6% respectively,
(a) find the new area.
(b) find the percentage decrease in area.



21. The scores of team A and team B were the same at the beginning of a competition. After a round, the score of team A increased by 80, and that of team B increased to 240.
(a) If the score of team A increased by 40%, find the scores of the two teams at the beginning.
(b) Find the percentage increase in the score of team B.

5.4 Profit and Loss

A Profit

In a trading activity, the amount spent on buying an item is called the **cost**, the amount received from selling the item is called the **selling price**. When the selling price is higher than the cost, a **profit** is made.

$$\text{Profit} = \text{Selling price} - \text{Cost}$$

Class Activity 5.4

Aim: To develop the concept of expressing profit in percentage

Joey is planning to sell items A and B in a carnival.

- (a) The cost and selling price of each item of A and B are recorded respectively as follows. Complete the table.

	Cost (\$)	Selling price (\$)	Profit (\$)
A	4	8	4
B	10	18	8



- (b) If Joey spends \$100 each on buying items A and B, and all of the items are sold out, complete the table.

	Number of items for \$100	Profit on each item (\$)	Total profit (\$)	Profit as a percentage of cost
A	25	4	100	100%
B	10	8	80	80%

- (c) If Joey spends the same amount of money on buying items A and B, and all of the items are sold out, item A is more profitable.

Now I see ...

Expressing the relation between profits and costs in percentage can help in comparing profits from different items efficiently.



cost 成本

selling price 售價

profit 盈利

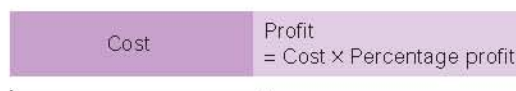
In fact, calculating profit in percentage is an application of percentage increase. We call this percentage increase a **percentage profit**.

$$\text{Percentage profit} = \frac{\text{Profit}}{\text{Cost}} \times 100\%$$

Note: Profit = Cost \times Percentage profit

Selling price = Cost + Profit

= Cost \times (1 + Percentage profit)



Selling price

Figure 5.4

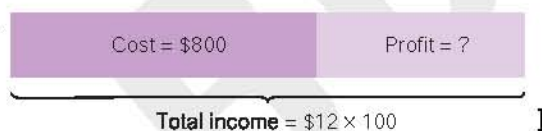
Example 5.15 Finding the percentage profit with cost and selling price given

Miss Cheung bought 100 flowers for \$800 and sold them for \$12 each. Find the percentage profit from the sale of all the flowers.



Solution

[Analysis: For 100 flowers,



$$\begin{aligned}\text{Total income} &= \$12 \times 100 \\ &= \$1\,200\end{aligned}$$

$$\begin{aligned}\text{Profit} &= \text{Income} - \text{Cost} \\ &= \$1\,200 - \$800 \\ &= \$400\end{aligned}$$

$$\begin{aligned}\therefore \text{Percentage profit} &= \frac{400}{800} \times 100\% \\ &= \underline{50\%}\end{aligned}$$

Example 5.16 Finding the selling price with cost and percentage profit given

Janet bought a dozen of decorations for \$480 and sold them at a profit of 60%. Find the selling price of each decoration.



percentage profit 盈利百分率

Classwork 5.15

Mrs. Wong bought 200 *fluorescent rods* for \$40, and sold them for \$0.5 each. Find the percentage profit from the sale of all the fluorescent rods.

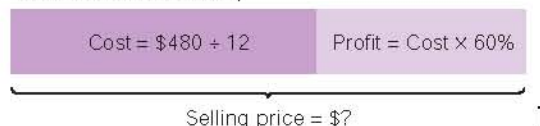
Classwork 5.16

Kenny bought 20 comic books for \$540 and sold them at a profit of 40%. Find the selling price of each comic book.

fluorescent rods 螢光棒

Solution

[Analysis: For each decoration,



$$\begin{aligned}\text{Cost of each decoration} &= \$480 \div 12 \\ &= \$40\end{aligned}$$

$$\begin{aligned}\text{Profit made on each decoration} &= \$40 \times 60\% \\ &= \$24\end{aligned}$$

$$\begin{aligned}\text{Selling price of each decoration} &= \text{Cost} + \text{Profit} \\ &= \$40 + \$24 \\ &= \underline{\underline{\$64}}\end{aligned}$$

Alternative method:

[Analysis: For each decoration,



$$\begin{aligned}\text{Cost of each decoration} &= \$480 \div 12 \\ &= \$40\end{aligned}$$

$$\begin{aligned}\text{Selling price of each decoration} &= \text{Cost} \times (1 + \text{Percentage profit}) \\ &= \$40 \times (1 + 60\%) \\ &= \underline{\underline{\$64}}\end{aligned}$$



Example 5.17 More complicated problem on percentage profit

The percentage profit is 32% when a vacuum bottle is sold for \$99.

- Find the cost of a vacuum bottle.
- If a vacuum bottle is sold for \$87, find the percentage profit.



Solution

- Let C be the cost of a vacuum bottle.

$$\begin{aligned}C(1 + 32\%) &= 99 && \leftarrow \text{Selling price} = \text{Cost} \times (1 + \text{Percentage profit}) \\ C &= 99 \div (1 + 32\%) \\ &= 75\end{aligned}$$

\therefore The cost of a vacuum bottle is \$75.



Classwork 5.17

The percentage profit of selling a desk for \$950 is 52%.

- Find the cost of a desk.
- If a desk is sold for \$850, find the percentage profit.

$$\begin{aligned}
 \text{(b) Profit} &= \text{Selling price} - \text{Cost} \\
 &= \$87 - \$75 \\
 &= \$12
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Percentage profit} &= \frac{12}{75} \times 100\% \\
 &= \underline{\underline{16\%}}
 \end{aligned}$$

B Loss

When the selling price of an item is lower than its cost, there will be a **loss**.

$$\text{Loss} = \text{Cost} - \text{Selling price}$$

In fact, calculating loss in percentage is an application of percentage decrease. We call this percentage decrease a **percentage loss**.

$$\text{Percentage loss} = \frac{\text{Loss}}{\text{Cost}} \times 100\%$$

Note:

$$\begin{aligned}
 \text{Loss} &= \text{Cost} \times \text{Percentage loss} \\
 \text{Selling price} &= \text{Cost} - \text{Loss} \\
 &= \text{Cost} \times (1 - \text{Percentage loss})
 \end{aligned}$$

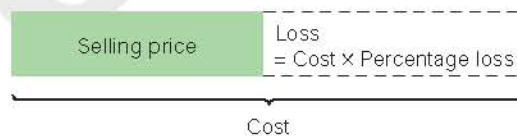


Figure 5.5

Example 5.18 Finding the percentage loss with loss and selling price given

A mobile phone is sold for \$1 885 at a loss of \$1 365. Find the percentage loss.

Solution

[Analysis:



$$\begin{aligned}
 \text{Cost of the mobile phone} &= \text{Selling price} + \text{Loss} \\
 &= \$1\,885 + \$1\,365 \\
 &= \$3\,250
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Percentage loss} &= \frac{1\,365}{3\,250} \times 100\% \\
 &= \underline{\underline{42\%}}
 \end{aligned}$$

Classwork 5.18

A vacuum cleaner is sold for \$986 at a loss of \$174. Find the percentage loss.

loss 虧蝕

percentage loss 虧蝕百分率



Example 5.19 Finding the selling price with loss and percentage loss given

John bought an MP3 player, and then sold it at a loss of 18%. It is known that he lost \$99. Find the selling price.



Solution

Let \$C\$ be the cost of the MP3 player.

$$C \times 18\% = 99 \quad \leftarrow \text{Loss} = \text{Cost} \times \text{Percentage loss}$$

$$\begin{aligned} C &= 99 \div 18\% \\ &= 550 \end{aligned}$$

\therefore The cost of the MP3 player is \$550.

$$\begin{aligned} \text{Selling price} &= \text{Cost} - \text{Loss} \\ &= \$550 - \$99 \\ &= \underline{\underline{\$451}} \end{aligned}$$



Classwork 5.19

Eason bought a watch and then sold it for \$37 below the original price. He made a loss of 4%. Find the selling price.



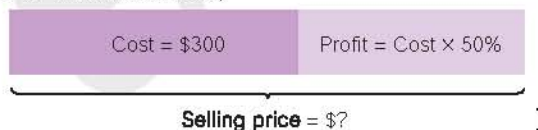
Example 5.20 Integrated problem on percentage profit and percentage loss

A wholesaler sells shoes which cost \$300 per pair to a retailer and makes 50% profit. The retailer then sells the shoes for \$360 each pair.

- Find the cost of each pair of shoes for the retailer.
- Does the retailer make any loss? Find the percentage profit or loss.

Solution

- (a) [Analysis: For the wholesaler,



$$\begin{aligned} \text{Profit on each pair of shoes made by the wholesaler} \\ &= \$300 \times 50\% \\ &= \$150 \end{aligned}$$

$$\begin{aligned} \text{Cost of each pair of shoes for retailer} &= \$300 + \$150 \\ &= \underline{\underline{\$450}} \end{aligned}$$

- (b) \because The cost (\$450) of each pair of shoes for the retailer is higher than the selling price (\$360) of each pair of shoes.
 \therefore The retailer makes a loss.



Classwork 5.20

A publisher sells story books which cost \$15 each to a retailer at 60% profit. The retailer then sells the story books for \$18 each.

- Find the cost of each story book for the retailer.
- Does the retailer make any loss? Find the percentage profit or loss.

For the retailer,

$$\begin{aligned}\text{Loss in each pair of shoes} &= \text{Cost} - \text{Selling price} \\ &= \$450 - \$360 \\ &= \$90\end{aligned}$$

$$\begin{aligned}\therefore \text{Percentage loss} &= \frac{90}{450} \times 100\% \\ &= \underline{\underline{20\%}}\end{aligned}$$

Skills Upgrading Corner 5.4

- Uncle Lee buys 20 *ice lollies* for \$80. If he sells 16 of them for \$5.5 each, and the rest for \$3 each, find the percentage profit.
- Winnie buys a set of ten different dolls for \$18 each, and then she sells them at a profit of 275%. Find the selling price of this set of dolls.
- Yesterday, Mr. Ho bought a box of oranges for \$150 and then sold it for \$120. Find the percentage loss.
 - Today, Mr. Ho also buys a box of oranges for \$150. If he sells it at a profit of \$180, find the overall percentage profit in these two days.

Exercise 5D

Level 1

- The cost of manufacturing a keyboard is \$12 000. If the manufacturer sells it to a retailer for \$15 000, find the percentage profit.
- Judy buys an LCD TV set for \$8 400 and sells it for \$7 350. Find the percentage loss.
- Mr. Cheng sold a van for \$212 500 and made a loss of \$37 500. Find the percentage loss.
- A shop owner sold a book for \$599 and made a profit of \$99. Find the percentage profit.




5. Mrs. Kwan buys a set of jewellery for \$100 000 and sells it at a loss of 22.5%. How much does she sell it for?
6. Kenneth buys a dozen of pencils for \$36 and sells them at a profit of 40%. What is the selling price of each pencil?
7. The cost of 10 dozens of eggs is \$60. If half of the eggs are sold at a profit of 50%, and the rest are sold at a profit of 30%, find the profit from selling all the eggs.
8. Brian sold a pair of sport shoes at a profit of 35%. It is known that he gained \$350. How much did he buy the sport shoes for?
9. A car is sold for \$120 000 at a profit of 25%. Find the cost of the car.
10. A model ship is sold for \$225 at a loss of 25%. How much does it cost?



Level 2

11. May bought two concert tickets for her parents for \$240 each. Since her parents could not go, May sold the tickets to her friends at a profit of 10% for one and a loss of 10% for the other. Did she make any profit or loss at the end? Explain your answer.
12. Mr. Cheung sold his flat at a loss of 4% and he lost \$60 000. Find the selling price of this flat.
13. A magazine is sold for \$14 and the percentage profit is 75%. Find the profit.
14. A grocer buys 400 kg of potatoes for \$840. Among them, 10% are rotten. He sells the good ones for \$6.3 per kg. What is the percentage profit?
15. Mr. Ho buys 3 000 apples for \$5 000. Then he sells 50% of them at \$10 for 3, 30% of them at \$10 for 4 and the rest at \$10 for 5.
 - (a) Find Mr. Ho's total income from the sale of apples.
 - (b) Find the overall percentage profit.



16. Mark and Matthew each buy 16 000 shares for \$4.5 per share.
- Mark sells 10 000 shares for \$4 each and the rest for \$5.5 each. Excluding other charges, does he make a profit or a loss?
 - Matthew sells 10 000 shares for \$4.2 each and the rest for \$5.3 each. Excluding other charges, does he make a profit or a loss?
 -  Who do you think is better in investment? Explain briefly and find the overall percentage profit of that person.

17. The cost of manufacturing a chair is \$20. The chair is sold to a retailer at a profit of 25%. The retailer then sells the chairs for \$24 each.
- Find the cost of each chair for the retailer.
 - Does the retailer make any loss? Find the percentage profit or loss.



18. A portable game machine is sold for \$360. The percentage loss is 20%.
- Find its cost.
 - If the game machine is sold for \$369, find the percentage loss.
19. The percentage profit is 16% when a product is sold for \$725.
- Find the cost of the product.
 - To obtain a percentage profit of 40%, what should the selling price be?

20. A camera manufacturer sold a digital camera to an audio video shop for 22% more than the cost. The audio video shop sold the digital camera to a customer for \$10 309 and made a profit of 30%.
- Find the cost of the digital camera for the audio video shop.
 - Find the cost of the digital camera for the manufacturer.
 - If the manufacturer sells the camera to the customer directly for \$10 075, what is the percentage profit?

21. An electrical appliances store is ready to close down. An electrical fan is sold at a loss of 40% and the loss is \$242. A washing machine is sold for \$2 541 and the percentage loss is 16%.
- What are the respective costs of the electrical fan and the washing machine?
 - What is the overall percentage loss?



5.5 Discount

During sales promotion, some shops would like to reduce the original prices (**marked prices**) of some items by certain amounts to attract more customers. The reduction in price is called a **discount**. When it is expressed as the percentage of the marked price, the percentage is called **percentage discount**.

$$\text{Discount} = \text{Marked price} - \text{Selling price}$$

$$\text{Percentage discount} = \frac{\text{Discount}}{\text{Marked price}} \times 100\%$$

Note: $\text{Discount} = \text{Marked price} \times \text{Percentage discount}$

$$\text{Selling price} = \text{Marked price} - \text{Discount}$$

$$= \text{Marked price} \times (1 - \text{Percentage discount})$$



Figure 5.6

Percentage discount is an application of percentage decrease. In daily life, when two items are sold at '20% off' and '15% off', their selling prices are 80% and 85% of the marked prices respectively, i.e. the two items are sold at percentage discount of 20% and 15% respectively.

Example 5.21

Finding the discount and selling price with marked price and percentage discount given

A pair of shoes with a marked price of \$70 is sold at 20% off.

- Find the discount.
- Find the selling price.



Solution



$$\begin{aligned} \text{(a) Discount} &= \$70 \times 20\% \\ &= \underline{\underline{\$14}} \end{aligned}$$

$$\begin{aligned} \text{(b) Selling price} &= \text{Marked price} - \text{Discount} \\ &= \$70 - \$14 \\ &= \underline{\underline{\$56}} \end{aligned}$$



Classwork 5.21

A handicraft with a marked price of \$500 is sold at 30% off.

- Find the discount.
- Find the selling price.

marked price 標價

discount 折扣

percentage discount 折扣百分率

Example 5.22 Finding the marked price with percentage discount and selling price given

Alan buys a suit for \$420 at a discount of 25%. What is the marked price of the suit?

Solution

Let $\$p$ be the marked price of the suit.

$$p(1 - 25\%) = 420$$

$$\begin{aligned} p &= 420 \div (1 - 25\%) \\ &= 560 \end{aligned}$$

\therefore The marked price of the suit is \$560.



Classwork 5.22

Crystal buys a set of toys for \$320 at a discount of 20%. What is the marked price?

Example 5.23 Integrated problem on buying and selling

The marked price of a steam iron is 25% higher than its cost. It is sold at 12% off during a sale, and the discount is \$84.

- Find its marked price and cost.
- Find its percentage profit.

Solution

- Let $\$m$ be the marked price of the steam iron.

$$m \times 12\% = 84$$

$$\begin{aligned} m &= 84 \div 12\% \\ &= 700 \end{aligned}$$

\therefore The marked price is \$700.

Let $\$C$ be the cost of the steam iron.

$$C(1 + 25\%) = 700$$

$$\begin{aligned} C &= 700 \div (1 + 25\%) \\ &= 560 \end{aligned}$$

\therefore The cost is \$560.



Classwork 5.23

The marked price of a model is 52% higher than its cost. If a customer buys it during the promotional period, he can enjoy a 25% discount and save \$95.

- Find the marked price and the cost of the model.
- Find the percentage profit of the model.

(b) [Analysis:




$$\begin{aligned}\text{Selling price} &= \text{Marked price} - \text{Discount} \\ &= \$700 - \$84 \\ &= \$616\end{aligned}$$

$$\begin{aligned}\text{Profit} &= \$616 - \$560 \\ &= \$56\end{aligned}$$

$$\begin{aligned}\therefore \text{Percentage profit} &= \frac{56}{560} \times 100\% \\ &= \underline{\underline{10\%}}\end{aligned}$$

Skills Upgrading Corner 5.5

- Frankie and 9 classmates go to the Water World and enjoy an offer of '10 tickets for the price of 8'. Find the percentage discount this offer provides.
- The original marked price of a *china* plate is \$4 200. If the shop owner raises the marked price by 15%, and then sells it at 20% off,
 - find the new marked price.
 - find the selling price.
 - find the overall percentage discount.
-  Refer to the details of the following leaflet and coupon.



- According to the above information, how could you get the largest percentage discount? What is the percentage discount?
- Do you think there is any misleading information in the leaflet? Explain briefly.

china 瓷器

redeem 兑换



Exercise 5E

Level 1


- Miss Chan buys a shirt with a marked price of \$125 at a discount of 20%. How much does she save?
- The marked price of a carpet is \$1 800. If it is sold at 40% off,
 - what is the discount?
 - what is the selling price?
- The marked price of a puzzle is \$120. Its selling price is \$102. Find the percentage discount.
- Mr. Ng buys a pair of trousers for \$96 at a discount of 25%. Find the marked price of the trousers.
- David saves \$12 by buying a basketball at a 15% discount. What is the marked price of the basketball?
- A necklace is sold at a 30% discount and its selling price is \$140.
 - Find the marked price.
 - What is the discount?
- Peter buys a dozen of pens at 45% off and saves \$27.
 - Find the marked price of a dozen of pens.
 - Find the selling price of each pen.
- The table below shows the marked prices and percentage discount for the same watch at three shops. Which shop sells the watch at the lowest price?



Shop	Marked price	Percentage discount
A	\$500	15%
B	\$400	10%
C	\$600	45%



Level 2

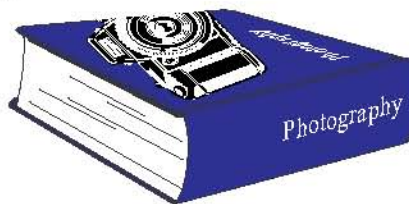
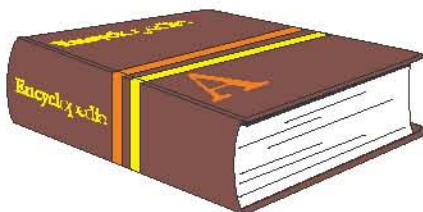
- A hotel provides a special offer for buffet dinner. For every 5 persons who enjoy the buffet dinner, one of them will get it free. Find the percentage discount.
-  Bakery A sells cakes at a 20% discount. Bakery B offers a promotion of 'buy 3 get 1 free'. If the marked price of each cake at both bakeries are the same, which one offers a larger discount for buying a dozen of cakes? Explain your answer.

11. Mrs. Ma buys a coat with a marked price of \$1 250 at 60% off.
 - (a) Find the selling price of the coat.
 - (b) If Mrs. Lee gets an extra discount of \$100 for the same coat, find the percentage discount for Mrs. Lee.
12. The marked price of a TV set is \$4 000. The wholesaler offers a 30% discount to the retailer.
 - (a) Find the cost of the TV set for the retailer.
 - (b) If the retailer sells it for \$3 024, find the percentage profit for the retailer.
13. A grocer bought 5 000 oranges for \$4 000. He sold 4 000 of them for \$1.2 each and the rest were sold at a discount of 40% on the cost.
 - (a) Find the total income received from selling all the oranges.
 - (b) Find the percentage profit.
14. The marked price of a game machine is \$500. If a shopkeeper raises the marked price by 20%, and sells it to a customer at a 20% discount,
 - (a) find the new marked price.
 - (b) find the selling price.
 - (c) find the overall percentage discount.
15. Ronald and Edmond buy the same product at the same price in shop A and shop B respectively.
 - (a) If Ronald saves \$18 at a discount of 25%, find the selling price of the product in shop A.
 - (b) If Edmond only saves \$13.5 when he buys the product in shop B, find the percentage discount offered by shop B.
16. The cost of an electrical appliance is \$1 000. The shop owner marked it at 60% higher than the cost.
 - (a) Find the marked price of the electrical appliance.
 - (b) The shop owner is adjusting the marked price of the electrical appliance such that its selling price will still be the same as the original marked price when it is sold at a 20% discount. Find the percentage increase in the marked price.
17. The marked price of a bookshelf is 65% higher than its cost. It is known that the bookshelf is sold at 60% off and the discount is \$792.
 - (a) Find the marked price and the cost of the bookshelf.
 - (b) Find the percentage loss of the bookshelf.
18. Susan bought a T-shirt marked \$120 at a discount of 40%, a pair of jeans marked \$180 at a discount of 20%, and a jacket marked \$300 at a certain discount. Since Susan paid the bill by credit card, she could have an extra discount of 10% and the amount she paid was \$437.4.
 - (a) If Susan paid the bill by cash, how much should she pay?
 - (b) Find the percentage discount of the jacket.



19. Joan is going to buy an *encyclopedia* and a photography book in a bookstore. The marked price and percentage discount for each book are as follows.

Encyclopedia
\$750 (10% off)



Photography
Book
\$210 (30% off)

Joan can buy any book at a discount of 15% using her VIP card offered by the bookstore, but she cannot use it with any other offers. How can she buy these two books at the largest discount? Explain briefly and find the amount paid by Joan.



Chapter Summary

A. Term Introduced

[This is a quiz to check your understanding of some special terms in this chapter. Match items in column A to column B appropriately.]

Column A

1. Percentage •
2. Profit •
3. Loss •
4. Discount •

Column B

- (a) The reduction in the price of goods.
- (b) The difference between the selling price and the cost when the selling price is higher than the cost.
- (c) The difference between the selling price and the cost when the cost is higher than the selling price.
- (d) A fraction with 100 as its denominator.

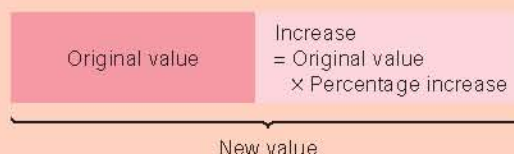
B. Fact to Remember

1. Percentage increase

$$(a) \text{ Percentage increase} = \frac{\text{Increase}}{\text{Original value}} \times 100\%$$

$$(b) \text{ Increase} = \text{Original value} \times \text{Percentage increase}$$

$$(c) \text{ New value} = \text{Original value} + \text{Increase} \\ = \text{Original value} \times (1 + \text{Percentage increase})$$

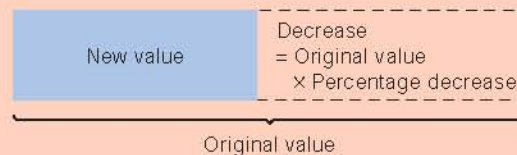


2. Percentage decrease

$$(a) \text{ Percentage decrease} = \frac{\text{Decrease}}{\text{Original value}} \times 100\%$$

$$(b) \text{ Decrease} = \text{Original value} \times \text{Percentage decrease}$$

$$(c) \text{ New value} = \text{Original value} - \text{Decrease} \\ = \text{Original value} \times (1 - \text{Percentage decrease})$$



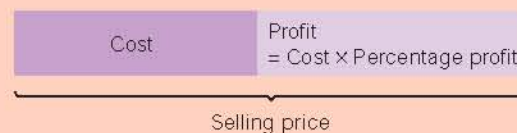
3. Profit

$$(a) \text{ Profit} = \text{Selling price} - \text{Cost}$$

$$(b) \text{ Percentage profit} = \frac{\text{Profit}}{\text{Cost}} \times 100\%$$

$$(c) \text{ Profit} = \text{Cost} \times \text{Percentage profit}$$

$$(d) \text{ Selling price} = \text{Cost} \times (1 + \text{Percentage profit})$$



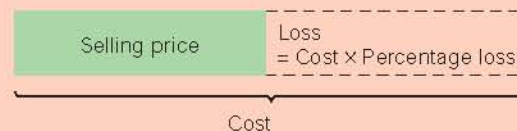
4. Loss

$$(a) \text{ Loss} = \text{Cost} - \text{Selling price}$$

$$(b) \text{ Percentage loss} = \frac{\text{Loss}}{\text{Cost}} \times 100\%$$

$$(c) \text{ Loss} = \text{Cost} \times \text{Percentage loss}$$

$$(d) \text{ Selling price} = \text{Cost} \times (1 - \text{Percentage loss})$$



5. Discount

$$(a) \text{ Discount} = \text{Marked price} - \text{Selling price}$$

$$(b) \text{ Percentage discount} = \frac{\text{Discount}}{\text{Marked price}} \times 100\%$$

$$(c) \text{ Discount} = \text{Marked price} \times \text{Percentage discount}$$

$$(d) \text{ Selling price} = \text{Marked price} \times (1 - \text{Percentage discount})$$



Check Yourself

[This is a quiz to remind you of the basic concepts you have learned in this chapter. Each question tests a concept under the section listed on the right. Failure in any part of a question indicates a need to do a revision on the section listed.]

1. Evaluate the following and express your answers in percentages.

(a) $92\% - 29\%$

(b) $30\% \times 60\%$

Section

5.1B

2. Fill in the blanks with suitable numbers. 5.2
- (a) _____ % of 50 is 20.
- (b) 150% of 200 is _____.
3. (a) Find the percentage increase if a number increases from 4 to 5. 5.3
- (b) A value decreases by 5 to 20. Find the percentage decrease.
4. (a) Mr. Tsang buys a model for \$300 and sells it at a profit of 30%. 5.4
- The selling price of the model is _____.
- (b) Miss Law sells a music box for \$120 at a loss of 20%. Find the cost.
5. (a) A book is sold for \$60 and its marked price is \$80. The 5.5
- percentage discount is _____.
- (b) The marked price of a toy is \$90 and it is sold at a discount of 15%. Find the discount.



Revision Exercise 5

Level 1

1. Evaluate the following and express your answers in percentages.
- (a) $6\% + 0.24$ (b) $0.7 - 0.7\%$
- (c) $80\% \times 0.5\%$ (d) $36\% \div 0.9$
2. Evaluate the following.
- (a) $24 \div (1 + 20\%)$ (b) $72 \times (1 - 22.5\%)$
- (c) $\frac{1}{3} \times (1 + 50\%) \times 0.02$ (d) $[(0.25 - 20\%) + \frac{4}{5}] \times 80\%$
3. Miss Lee spends 25% of her salary on a mobile phone. If her salary is \$8 500, how much does she spend on the phone?
4. Kylie buys a camera for \$2 000 with a marked price of \$2 500. Find the percentage discount of the camera.
5. A sitting room of 40 m^2 occupies 25% of a house. What is the size of the house?

6. After using 20% of a sum of money, there remains \$3 200. Find the original amount of the sum of money.
7. A book is sold for \$55 at a profit of 10%. Find the cost of the book.
8. Miss Lo buys an air ticket at a discount of \$840. If the percentage discount of the air ticket is 40%,
 - (a) find the original price of the air ticket.
 - (b) find the selling price of the air ticket.



Level 2

9. $\frac{2}{3}$ of a number is 7 more than 20% of 60. Find the number.
10. After A increases by 25%, it equals B . What percentage of B is the original value of A ?
11. Eric earns \$16 000 per month. He spends 35% of his salary on rent, 45% on others, and saves the rest.
 - (a) How much does Eric save each month?
 - (b) If Eric's salary and rent remain unchanged, but he wants to spend \$800 more on others, find the percentage decrease in his savings.
12. Fanny buys 2 metre of cloth for \$24 per metre to make a shirt. Also, she spends \$6 on cotton and buttons for the shirt.
 - (a) Find the cost of the shirt.
 - (b) If she sells the shirt at a 40% profit, find the selling price of the shirt.
13. The marked price of a flat is \$3 200 000. Mr. Kwok buys it at a 5% discount and sells it at a profit of 20%.
 - (a) How much does he buy the flat for?
 - (b) How much does he sell the flat for?
14. A shopkeeper buys a table for \$460 and 6 chairs for \$90 each. He sells the table at a profit of 30% and the chairs at a loss of 5%.
 - (a) Find the profit from selling the table.
 - (b) Find the loss in selling all the chairs.
 - (c) Find the overall percentage profit.



15. There were 60 members in the photography club last year. The number of its members increases by 45% this year.
- How many more members are there in the photography club this year?
 - If the number of members in the art club only increases by 20% this year but the number of members increased is the same as that of the photography club, how many members are there in the art club this year?
16. A watch is sold for \$1 840 at a profit of 15%. What should the selling price be such that the profit made is doubled?
17. The marked price of a kitchenware set is \$300. By what percentage should the marked price increase to maintain the selling price at \$300 after giving a discount of 20%?
18. 22.5%, 27.5% and 12% of the students in a secondary school are with types A, B and AB blood respectively, and 456 students are with type O blood.
- What percentage of students are with type O blood?
 - How many students are there in the school?
 - Among the students with types A, B, AB and O blood, 30%, 60%, 50% and 25% of them respectively are girls. What percentage of students in the school are girls?
19. An audio video store offers a sale. Compact discs with different marked prices are offered at different discounts as follows:

Marked price	Below \$65	\$65 - \$85	Above \$85
Discount	10% off	20% off	30% off

It is known that Susan buys four compact discs marked \$60, \$74, \$76 and \$90.

- Find the total selling price after discount.
 - Find the overall percentage discount of the transaction.
 - In addition to the above discount offer, the audio video store also provides an offer of 'buy 4 get 1 free'. For each purchase of five compact discs, the one with the lowest marked price will be free of charge. If Susan buys one more compact disc marked \$80, find the overall percentage discount of the transaction.
20. There are 900 students in a school, and 405 of them are boys. Also, 60% of the students are in junior forms, and 306 of them are girls.
- What percentage of the students are girls in the school?
 - What percentage of the senior students are girls?
 - How many boys are there in senior forms?
21. Rachel buys a hair dryer and a rice cooker for \$825 in total and then sells them at profits of 44% and 22% respectively. It is given that the hair dryer is sold for \$108.
- Find the respective costs of the hair dryer and the rice cooker.
 - What is the overall percentage profit of these two items?



22. Mr. Leung and his family go to Seafood Restaurant for dinner. They want to order a set dinner for four people, and there are two different choices. (See the figure on the right)

It is known that Mr. Leung has got a \$20 coupon which cannot be used together with other offers, and he could enjoy a 5% off the bill if he pays it with his Eastern Bank credit card.

Determine which set dinner and offer should Mr. Leung choose to let him enjoy

- the largest discount.
- the largest percentage discount.

Seafood Restaurant	
【Deluxe Set】 \$420 Soup Barbecue Pork and Chicken Steam <i>Abalone</i> Mixed Vegetable Pot Garlic Rib	【Combo Set】 \$360 Soup Barbecue Pork and Chicken Steam Fish Sweet & Sour Rib Fried Vegetable
Including: tea, rice, fruit, 10% service charge	

MC Question

23. Which of the following is/are correct?

- $40\% + 60\% = 1$
 - $10\% \times 10\% = 100\%$
 - $100\% \div 20\% = 5\%$
- I only
 - II only
 - I and II only
 - II and III only

☐

24. If x is 25% more than y , then y is

- 10% less than x .
- 15% less than x .
- 20% less than x .
- 25% less than x .

☐

25. The weight of Andy increased from 30 kg to 33 kg. The percentage increase in his weight is

- $9\frac{1}{11}\%$.
- 10%.
- 90%.
- $90\frac{10}{11}\%$.

☐

26. The 300 members in the gardening club have one vote each to elect the chairperson. It is known that 55% of the members have voted. How many members have not yet voted?

- 135
- 140
- 160
- 165

☐

27. A man sold a toy for \$100 and made a loss of \$20. Find the percentage loss.

- 6%
- $16\frac{2}{3}\%$
- 20%
- 25%

☐

28. The marked price of a product is \$210, which is 40% higher than its cost. If it is now selling at a discount of 10%, what is the percentage profit?

- $18\frac{4}{7}\%$
- 26%
- 30%
- 40%

☐

abalone 鮑魚



Problem-solving and Exploring



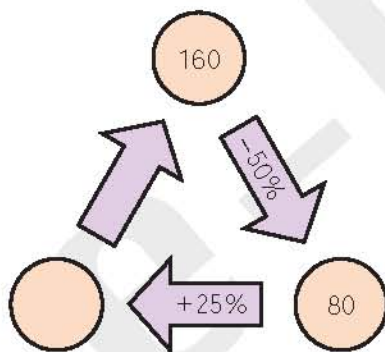
Hint for the Title Page Question

- (a) Suppose Charles' salary was \$10 000 last month before his pay rise,
- find his salary last month after the pay rise.
 - find his salary this month.
 - Compare his salary this month to the salary last month before the pay rise (\$10 000), which one is higher?
- (b) Suppose Charles' salary was \$ x last month before his pay rise,
- find his salary last month after the pay rise in terms of x .
 - find his salary this month in terms of x .
 - Compare his salary this month to the salary last month before the pay rise (\$ x), which one is higher?

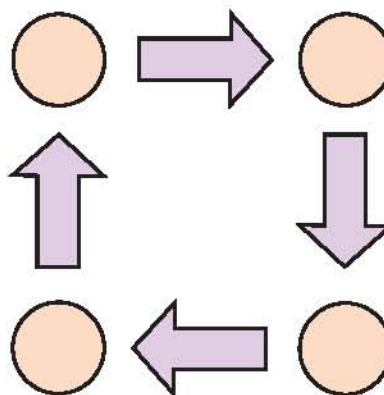


Additional Question

1. (a) In the figure below, fill in \bigcirc and \Rightarrow with the appropriate values and percentage increases/decreases.



- (b) Referring to the figure on the left, fill in \bigcirc and \Rightarrow in the figure below with possible values and percentage increases/decreases.



2. Eason is going to choose 3 of the following items as Christmas gifts.

Item	Photo frame	Puzzle	Glass	Model car	Decoration
Marked price	\$70	\$120	\$60	\$150	\$100

He has 3 coupons which can let him enjoy 40%, 20% and 10% discounts. Each of them can be used only once and is only valid for one item.

- Select 3 items for Eason at random, and match each coupon to each item appropriately so that Eason can spend the least for the Christmas gifts.
- Based on the choices in (a), find the overall percentage discount.

